



## First record of *Pilumnopeus convexus* (Maccagno, 1936) (Crustacea, Decapoda, Pilumnidae) from the Indian coast

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### Abstract

*Pilumnopeus convexus* (Maccagno, 1936) (Pilumnidae) is recorded for the first time across the Indian coast. The species has so far been reported from coastal waters of the Red Sea, Pakistan and Persian Gulf. *P. convexus* can be easily distinguished from closely related species in having transversely hexagonal carapace, acute anterolateral teeth and tip of the male left gonopod curved to form a hook like structure. Possible explanations to the new record are discussed.

### Key words

Geographic distribution extension; rubble shore; first record; Arabian Sea.

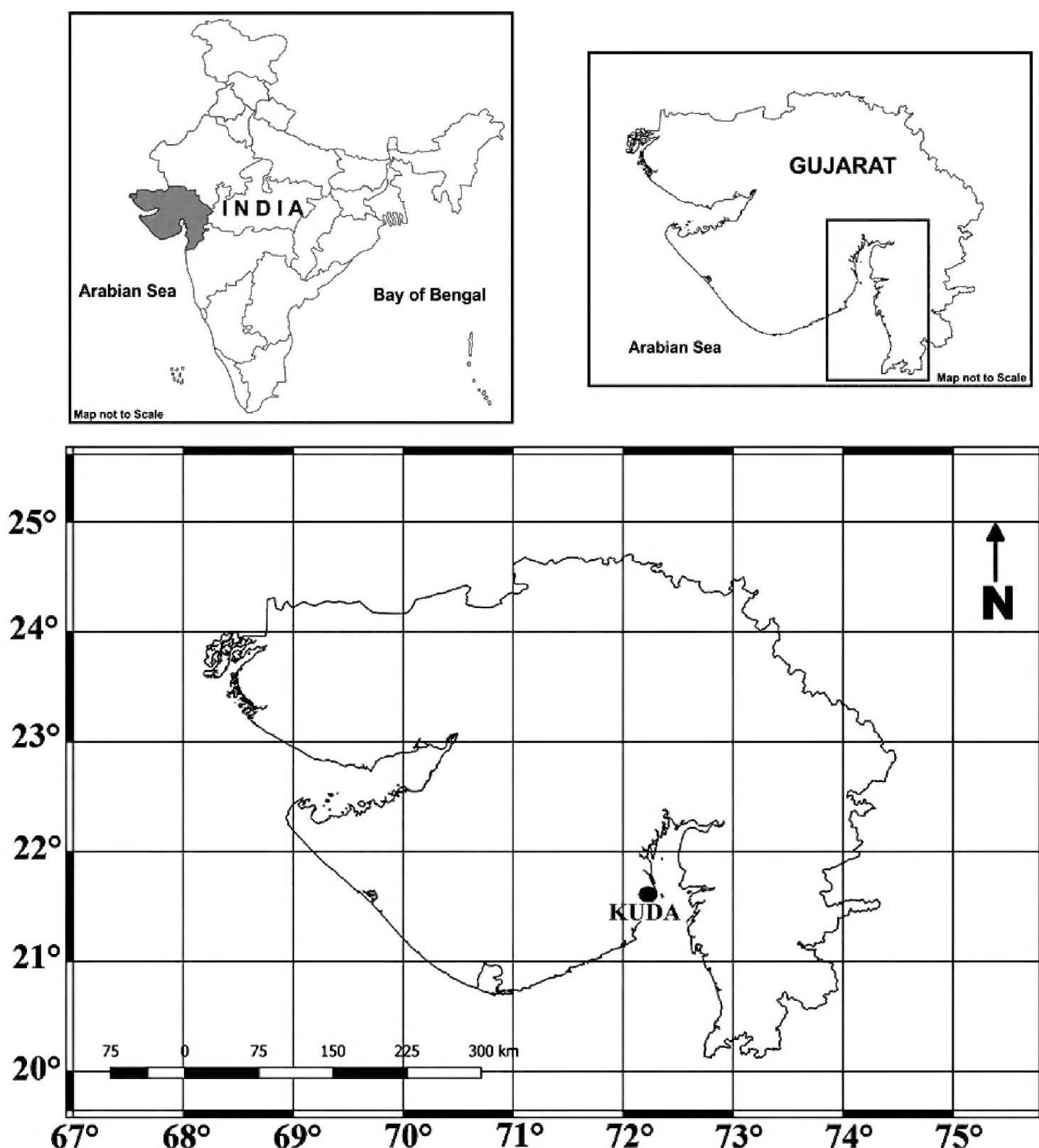
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### Introduction

Brachyuran crab species of the family Pilumnidae Samouelle, 1819 are inhabitants of rocky and muddy shores of tropical and subtropical seas (Davie 1989, Ghani & Davie 2000; Kaullysing et al. 2015; Trivedi et al. 2015). The family is currently composed of 5 subfamilies (Calmaniinae Števčić, 1991, Eumedoninae Dana, 1852, Pilumninae Samouelle, 1819, Rhizopinae Stimpson, 1858, Xenophthalmodinae Števčić, 2005), 69 genera and 394 species (Davie et al. 2015). DAVIE (1989) revised the taxonomy of 2 genera, *Pilumnopeus* A. Milne Edwards, 1863 and *Heteropanope* Stimpson, 1858, and proposed the new genus *Benthopanope* Davie, 1989 to accommodate 5 species previously described under these genera. *Pilumnopeus* differs from *Heteropanope* in having the carapace more convex and narrower and rounded in front, and with 8 sternites visible laterally on

the male abdomen (Davie 1989). Currently, *Pilumnopeus* contains 10 well-recognised species (Davie 1989, Ng et al. 2008, Ghory et al. 2013), but *Pilumnopeus convexus* (Maccagno, 1936) is taxonomically problematic. This species was originally described from Ethiopia based on 2 female specimens (Maccagno 1936), but later Davie (1989) redescribed *P. convexus* based on a female lectotype collected from Ethiopia and illustrated the carapace and cheliped of this specimen. More recently, Ghory et al. (2013) discussed the taxonomy of *P. convexus* and *P. salomonensis* Ward, 1942 and assigned *P. salomonensis* as junior synonym of *P. convexus*. *Pilumnopeus convexus* is recorded to date from the coast of Ethiopia (Maccagno 1936), South Africa (Barnard 1955), Red Sea (Apel 2001); Iran (Naderloo and Türkay 2012, Naderloo et al. 2013); Saudi Arabia and Bahrain (Apel 2001), UAE (Cooper 1997, Apel 2001), and Pakistan (Ghani and Davie 2000, Ghory et al. 2013). The present study records *P. convexus*



**Figure 1.** Map showing the location of the new record of *Pilumnopeus convexus* (Maccagno, 1936) at Kuda ( $21^{\circ}37'33''$  N,  $072^{\circ}18'17''$  E), Gujarat, India.

for the first time in Indian waters and suggests a possible explanation for its occurrence there.

## Methods

One male and 2 females of *P. convexus* were collected from the coast at Kuda village ( $21^{\circ}37'33''$  N,  $072^{\circ}18'17''$  E) (Fig. 1), which is located in Gulf of Khambhat (Bhavnagar District, Gujarat state, India). Specimens were collected by hand picking from a rocky rubble intertidal shore during low tide. Photographs were taken from freshly caught specimens in the laboratory using a Canon 1000D camera with a 18–55 mm lens. Crabs were preserved in 70% alcohol and deposited in the Zoology Museum, Department of Zoology, Faculty of Science, the Maharaja Sayajirao University of Baroda, Vadodara, Gujarat, India with accession number (ZL-AR-CR-100). Terminology used for morphological descriptions follows Ghory et al. (2013): carapace length (CL), measured along the vertical median line of the carapace; carapace width (CW), measured horizontally at the widest point of the carapace; and male first gonopod and male second

gonopod (G1 and G2, respectively). Morphometric characters were measured in millimetres using digital caliper to the nearest 0.01 mm.

## Results

Order Decapoda Latreille, 1802

Infraorder Brachyura Latreille, 1802

Family Pilumnidae Samouelle, 1819

Subfamily Pilumninae Samouelle, 1819

Genus *Pilumnopeus* A. Milne-Edwards, 1867

***Pilumnopeus convexus* (Maccagno, 1936) (Figs. 2–7)**

*Heteropanope convexa* Maccagno 1936: 176.

*Pilumnopeus salomonensis* Ward 1942: 96—Davie 1989: 143, Ng et al. 2008: 141.

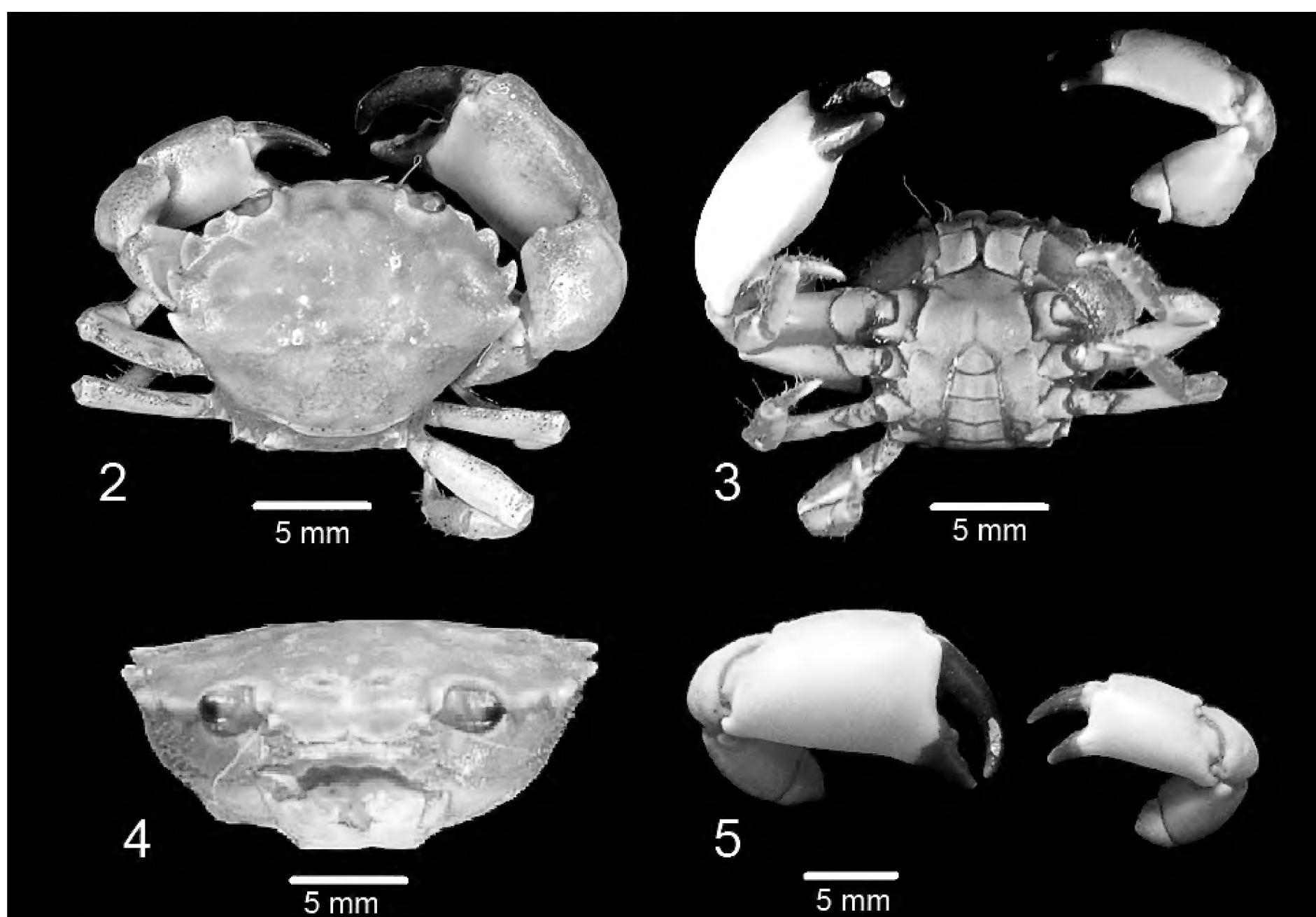
*Pilumnopeus vauquelini* Stephensen 1946: 141.

*Pilumnopeus indica* Barnard 1955: 30.

*Pilumnopeus convexa* Davie 1989: 142.

*Pilumnopeus convexus*—Cooper 1997: 171, Ng et al. 2008: 141, Ghory et al. 2013: 303.

**Material examined.** ZL-AR-CR-100, 1 male (CW 15.38 mm, CL 11.36 mm), 2 females (CW 11.91 mm, CL



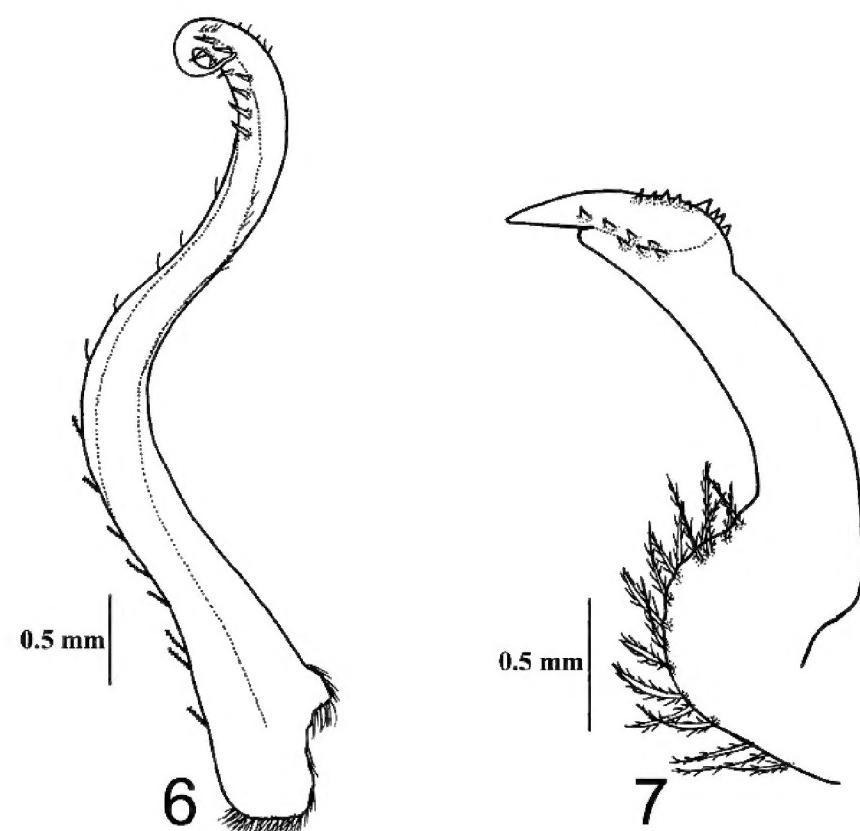
**Figures 2–5.** *Pilumnopeus convexus* (Maccagno, 1936), male (CW: 15.38mm, CL: 11.36mm) (ZL-AR-CR-100), Gujarat, India. **2.** Dorsal view. **3.** Ventral view. **4.** Frontal view. **5.** Chelipeds outer view.

8.47 mm; CW 12.85 mm, CL 8.60 mm), Kuda ( $21^{\circ}37'33''$  N,  $072^{\circ}18'17''$  E), muddy rubble shore, 12 October 2016, collector Jignesh Trivedi.

**Diagnosis** (modified from Ghory et al. 2013). Carapace hexagonal (Fig. 2), broader than long, frontal margin (Fig. 4) bilobed forming an external angle; margin of lobe slightly convex; inner supraorbital tooth with an outer frontal angle, forming a V-shaped notch in which antenna fits; supraorbital margin with 2 fissures, dorsal surface with rows of small rounded granules on frontal, gastric, branchial and cardiac regions, scattered plumose setae of different sizes on branchial region, 3 teeth on anterolateral margin after external orbital angle; first anterolateral tooth blunt, second and third teeth sharp but not pointed.

Chelipeds subequal (Fig. 5), right larger; larger chela smooth; smaller chela finely granulated; carpus with 1 lobe distally, fingers shorter than palm, cutting edges of fingers slightly toothed. Ambulatory legs reasonably shorter than larger cheliped; unarmed coxa, merus, carpus and propodus; covered with long and short dispersed setae; dactylus slightly curved with slightly tapering tip.

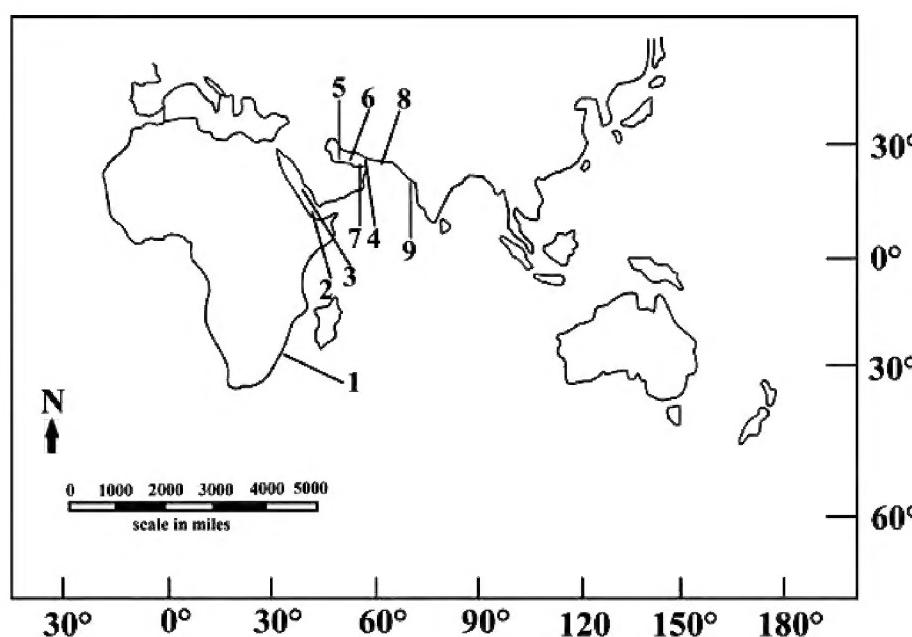
First and second thoracic sternites (Fig. 3) completely fused; second and third sternites separated by almost straight groove; sternite 8 not visible in ventral view, laterally beside the abdomen. Abdomen with 7 segments including telson, covered with fine setae; telson triangular with curved apex. G1 (Fig. 6) sinuous, slender; distal



**Figures 6, 7.** *Pilumnopeus convexus* (Maccagno, 1936), male (CW: 15.38mm, CL: 11.36mm) (ZL-AR-CR-100), Gujarat, India. **6.** G1 dorsal view (left). **7.** G2 dorsal view (left).

part markedly recurved, hook like, tip elongated, with numerous subdistal spines. G2 (Fig. 7) short, sigmoid, armed with distal spines.

**Colouration in life.** Male: Carapace olive with reddish brown spots on urogastric, cardiac and intestinal regions. Chelipeds olive, dorsal surface of palm and carpus reddish, inner surface white, fingers black. Ambulatory legs



**Figure 8.** Map showing distribution range of *Pilumnopeus convexus* (Maccagno, 1936): (1) Durban Bay, South Africa (Barnard 1955), (2) unknown locality, Ethiopia (Maccagno 1936), (3) unknown locality, Red Sea (Apel 2001), (4) Qeshm Island, Persian Gulf, Iran (Naderloo and Türkay 2012, Naderloo et al. 2013), (5) unknown locality, Saudi Arabia (Apel 2001), (6) unknown locality, Bahrain (Apel 2001), (7) Abu Dhabi, UAE (Cooper 1997, Apel 2001), (8) Somar Goth, Pakistan (Ghani and Davie 2000, Ghory et al. 2013), (9) Kuda, Gujarat state, India (present study).

brown with red spots. Female: Carapace cream with reddish brown patch from mesogastric region to intestinal region. Cheliped outer surface reddish brown, inner surface white, fingers brown. Ambulatory legs brown with red spots.

**Habitat.** The species occurs on rocky rubble shore line.

**Distribution.** The distribution range of *P. convexus* is shown in Fig. 8.

## Discussion

Morphological examination of the newly examined specimens of *P. convexus* corresponds with previous descriptions of the same species by Barnard (1955), Davie (1989), and Ghory et al. (2013). Indeed, the newly collected crabs have hexagonal carapace, bilobed frontal margin, structure of anterolateral teeth, armature of chelipeds and ambulatory legs. However, the newly collected specimens differ from the previous descriptions of *P. convexus* (Barnard 1955, Davie 1989, Ghory et al. 2013) by the placement of sternite 8 and the morphology of G1. Sternite 8 is not visible in the ventral view of the new specimens, while it is clearly visible in specimens examined by Davie (1989) and Ghory et al. (2013). The G1 of the male specimen examined in the present study has an elongated tip compared to specimens described and figured by Barnard (1955) and Ghory et al. (2013). Such noticeable variations could be related to the difference in the size of specimens (Ghory et al. 2013).

*Pilumnopeus convexus* was initially described from the coastal areas of Ethiopia (Maccagno 1936) and subsequently recorded from South Africa (Barnard 1955), Red sea (Apel 2001); Iran (Naderloo and Türkay, 2012, Naderloo et al. 2013); Saudi Arabia and Bahrain (Apel 2001),

UAE (Cooper 1997, Apel 2001), and Pakistan (Ghani and Davie 2000, Ghory et al. 2013) and now from Kuda village of Gujarat state, India which is more than 1000 km from the site mentioned by Ghory et al. 2013. The present study expands the geographic distribution of *P. convexus* in the Arabian Sea and Indian Ocean. Recently, many brachyuran crab species (i.e., *Atergatis oxyroe* (Herbst, 1901) (Tirmizi and Ghani 1996); *Cryptopodia angulata* H. Milne Edwards & Lucas, 1841 (Tirmizi and Kazmi 1983); *Dentoxanthus iranicus* Stephensen, 1945 (Tirmizi and Serène 1971, Tirmizi and Kazmi 1982); *Macrophthalmus (Mareotis) laevis* A. Milne-Edwards, 1867 (Tirmizi and Ghani 1988); *Opusia indica* (Alcock, 1900) (Alcock 1900, Ng et al. 2009)), which are common along the Pakistan coast, have been recorded for the first time from northwestern coastal India (Trivedi and Vachhrajani 2013, Trivedi et al. 2014, Ng et al. 2015, Trivedi and Vachhrajani 2016, Trivedi et al. 2017).

Two explanations can be provided for the geographic distribution of these brachyuran crab species, including *P. convexus*, in northwestern Indian waters. Firstly, the coastal area of Pakistan and Gujarat state, India have a similar marine habitat including rocky and muddy shores, mangroves, and estuaries (Trivedi and Vachhrajani 2012, Trivedi et al. 2012, Shukla et al. 2013). Secondly, the circular movement of surface current of northern Arabian Sea could mediate the transport of larvae of these brachyurans from Pakistani waters to coastal northwestern India (Shetye 1994).

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## Authors' Contributions

JNT collected the specimens; SSG, JNT, DJT examined and identified the specimens; DJT prepared the drawings; SSG, JNT and KDV prepared, reviewed and finalized the manuscript. All authors read and approved the manuscript.

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